THE SANITARY CONDITIONS AND DISEASES PREVAILING IN MANÁOS, NORTH BRAZIL, 1905-1909, WITH PLAN OF MANÁOS AND CHART

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Expedition to the Amazon, 1905-1909

(*Fifteenth Expedition of the Liverpool School of Tropical Medicine.*)

Manáos, the capital of the State of Amazonas, was selected as the headquarters of the Expedition. It is the second largest city in the Amazon district and is one of the most important cities in North Brazil.

The city is situated on the Rio Negro, a few miles above its confluence with the River Amazon, and lies in latitude 3° 08′ 30″ and longitude 59° 59′ 27″ west of Greenwich; its height above the sea level is only about 3·40 metres. It is 900 miles' river journey from the city of Pará at the mouth of the Amazon river and 1,300 miles from the town of Iquitos, Peru. The traffic is entirely carried on by ocean and river steamers of up to 6,000 tons, plying between Hamburg, Liverpool, New York and Manáos.

The population of Manáos is about 60,000, comprising some 33,000 intra-urban and 28,000 extra-urban inhabitants. The greater number are Amazonenses (persons born in the Amazon State), but many Brazilians from other States, especially Cearenses, have settled in the city. There are about 4,000 to 5,000 foreigners, chiefly Portuguese, Italians and Spaniards, with some hundreds of Americans, English, French, Germans, Syrians and Turks.

It is impossible to give accurate figures, as there is a large floating population. Manáos is the commercial centre of the vast rubber trade of the State. The port is used by all the river steamers, and is the arrival and departure point for all those connected with the rubber trade of the interior. The following tables, compiled from figures by Dr. Alfredo da Matta,* give an idea of the foreign and national passenger movement in the Port of Manáos.

FOREIGNERS ARRIVING AND DEPARTING

	Arrivals			Departures		
Year	From interior	From exterior	Total	For interior	For exterior	Total
1901 ...	1,208	2,953	4,161	483	3,189	3,672
1902 ...	1,294	3,165	4,459	589	3,189	3,778
1903 ...	1,230	3,074	4,304	476	3,340	3,816
1904 ...	560	1,660	2,220	243	2,066	2,309
1905 ...	763	4,911	5,674	385	3,563	3,948

BRAZILIANS ARRIVING AND DEPARTING

	Arrivals			Departures		
Year	From interior	From exterior	Total	For interior	For exterior	Total
1901 ...	13,647	18,766	32,413	12,872	13,534	26,406
1902 ...	12,011	11,859	23,870	10,371	9,768	20,139
1903 ...	16,131	13,375	29,506	7,749	10,597	18,346
1904 ...	9,634	15,610	25,244	7,959	7,609	15,568
1905 ...	17,435	21,310	38,745	11,104	13,069	14,173

Climatology.

Complete observations are difficult to obtain, but the following table, compiled by Dr. Lopes de Campos† for the year 1903, gives a fair idea of the conditions in Manáos.

* Dr. Alfredo da Matta. Paludismo, Variola, Tuberculose em Manáos. Revista Medical de S. Paulo, Nos. 14 and 15, 1908.

† Dr. Lopes de Campos. Climatologia Medica do Estado do Amazonas Imprensa Official. Manáos, 1903.

Month	Rainfall in millimetres	Number of days on which rain fell	Relative humidity	Velocity of wind in metres per second
January ...	214	23	78	1·77
February ...	201·2	19	79	2·06
March ...	262	19	78	1·88
April ...	155	15	76·9	1·75
May ...	116	20	78	1·62
June ...	23	8	67·9	1·68
July ...	30·6	7	67·9	1·60
August ...	17·4	4	65·7	1·83
September ...	65·8	10	68·5	2·13
October ...	57·	8	63·9	2·43
November ...	69·4	14	70·2	1·89
December ...	184	22	73·4	1·79

The temperature, while not exceptionally high, is very constant. The hot months extend from September to January, the highest temperature occurring in October. The months of April and May are slightly cooler. During the rainy season a fall of two to four degrees centigrade occurs about daybreak, so that the early hours of the day are quite refreshing. The thermometer averages about 24·5° C. at 6 a.m., at which time there is generally a light N.E. breeze; at noon, a slight breeze may spring up for a short time.

MAXIMUM TEMPERATURES (CENTIGRADE) OF THE HOT MONTHS*

Year	September	October	November	December
1901 ...	32·7	32·9	32·6	31·9
1902 ...	35·8	37·5	36·6	35·0
1903 ...	35·6	36·6	36·0	35·0
1904 ...	35·1	37·2	36·4	36·4
1905 ...	36·0	36·4	35·0	35·0

AVERAGE TEMPERATURES

Year	Mean	Minimum	Maximum
1901 ...	27·3	24·3	37·4
1902 ...	27·9	20·7	34·3
1903 ...	28·5	22·0	36·0
1904 ...	28·8	21·8	32·7
1905 ...	28·8	22·2	36·4

* Dr. Alfredo da Matta, *loc. cit.*

A curious phenomenon is the cold spell of three days (*dias de friagem*) which may occur in the month of June. It is usually preceded by some heavy rains, mists and squalls. A very cold southerly wind occurs, accompanied by a rapid fall of temperature, reaching 16° C. in a few hours. In 1907 the *friagem* occurred in the first week in July, the temperature falling to 18° C.

The topography of Manáos is well seen on the accompanying plan. From the river bank the ground gradually rises towards the North, where a watershed causes the formation of two igarapés (*creeks*), the Igarapé da Cachoeira Grande on the West and the Igarapé da Cachoeirinha on the East. The city is intersected from North to South by the Igarapés Manáos and Bittencourt, while a small one, the Igarapé da Castelhana on the eastern side empties into the Igarapé da Cachoeira Grande. The Igarapés Cachoeira Grande and Cachoeirinha form very large collections of water at all times of the year.

The rise and fall of the Rio Negro is an important factor, there being a difference of 50 to 60 feet between highest and lowest river (Chart). The river is at its height in June, and then gradually recedes until the end of October. A slight rise may occur in November and be followed by a further slight fall. It then remains stationary until January, when it commences to rise. At low river, in consequence, the upper reaches of the smaller Igarapés Manáos, Bittencourt, etc., are dried up and, as the water recedes, many puddles and holes containing water are left to furnish breeding-places for mosquitos. At high river, the water from the Rio Negro has backed up in the igarapés, and vast areas of low-lying land are completely submerged. The offices of many of the chief commercial firms and banks being situated along the river front, an extremely high river causes much inconvenience and damage, as the cellars and low-lying sections of the streets become flooded. Since this condition persists for several weeks, the propagation of mosquitos and disease is favoured by these collections of stagnant water. The effective functioning of the low-level sewers is hindered, but this latter annoyance will be abolished by the new sewage lifting-pumps.

Streets. The general plan of the city shows many broad avenues and streets running North and South, and in places a number of squares. In the city proper the main streets are laid with granite

blocks, a few, however, having asphalt blocks; the less important streets are generally laid with rubble and macadam. The sidewalks are composed of stone slabs or artificial pavement, with gutters of stone.

Electric light is employed to illuminate the streets of the city and many of the houses and offices. The residents are fortunate in being able to use electric fans, as they are almost indispensable in cooling the rooms and driving away mosquitos.

The system of electric trams has proved a great boon to Manáos. The lines to Flores and other suburban parts are well patronised in the evenings by the residents for the cool ride through the swampy areas.

Disposal of refuse. Collection of house refuse is made nightly by scavengers, who give an efficient service to the residents of the centre of the city.

Drainage. There is a system of sewers for the intra-urban population, but none at all for the extra-urban inhabitants.

Water supply. The water supply is derived from the Rio Negro,* the inlet pipes being well above the city and sufficiently far from the shore to ensure a supply of uncontaminated river water. In 1909, a most elaborate filtration plant of automatic compressed air polarite filters was installed. The filtered water is pumped up to the two reservoirs, Mocò and Castelhana, which are built on the heights of

* The following analysis by Mr. W. J. Debdin, F.I.C., F.C.S., of samples of the Rio Negro water is reprodnced by the courtesy of the Manáos Improvements Co., Ltd., from a report prepared by Messrs. Beesley, Son & Nichols, M.Inst.C.E.

Appearance	Odour at 100° Fahr.	Total Solids		Phosphoric Acid	Hardness		Ammonia		Chlorine	Oxygen absorbed from Permanganate at 80° Fahr.		Organic Elements			Nitrogen as Nitrates, &c.	Cultivation on Gelatine Plates	Micro-Filter mm. per litre	Pathogenic Organisms	Microscopical Examination
		Grains per Gallon	Appearance on Ignition		Total	Permanent	Free	Albuminoid	Grains per Gallon	In 15 mins.	In 4 hrs.	Carbon	Nitrogen	Total	Grains per Gallon	Colonies per c.c.			
					Degrees		Grains per Gallon			Grains per Gallon		Parts per 100,000							
Brown colour with suspended particles	None	3·2	Blackened	Very slight trace	1·4	1·2	·0040	·0125	0·81	·566	·950	·800	·060	·860	0	684	11·0 Poisonous Metals Nil Strongly Plumbo-Solvent	Bacillus Coli Communis in 0·1 c.c. Streptococci not detected	Oxide of Iron and Peaty Matter. Numerous dead Aquatic Organisms. Daphina, &c. Conferoæ. Moving Organisms, Infusoria, Algæ, &c.

Manáos. The water is then conveyed to the houses of the inhabitants by gravitation through a system of pipes.

Both the drainage and water systems are being greatly improved and extended by the Manáos Improvements Company, Limited. A modern system of sewers, house connections, and sewage disposal is almost completed, and, with the new water supply, the sanitation of the city will be greatly improved. In so many tropical towns the great evils are the lack of a pipe-borne water supply and an efficient drainage system; the absence of these necessities naturally helping to propagate disease. With the completion of such important works, many of the present sanitary evils which prevail in Manáos should vanish.

Food supply. The cost of living is very great, the prices of actual necessities being absurdly high as compared with other tropical countries. The beef is of average quality, but the supply is limited. Cattle-raising is not taken up very extensively, as only certain parts of the State are suitable for ranches, but the Rio Branco and parts of the country along the Rio Amazonas are well adapted and furnish a fair number of cattle. Under such circumstances the poorer class of citizens in Manáos are rarely able to afford fresh beef, and their diet consists chiefly of dried beans, farinha, goat flesh, salt cod and some dried local fish, plantains, fruit. Fowls, ducks, eggs, etc., are all dear, the demand exceeding the supply. In consequence, large quantities are imported from South Brazil and the lower reaches of the Amazon district.

Fresh-water turtle and various kinds of fish are excellent and, during low river, are both cheap and abundant.

Many delicious and nourishing fruits grow wild in the State, but even the commoner ones fetch high prices, as the natives do not make any serious attempts to cultivate them. Green vegetables, such as lettuce and other salad greens, tomatoes, and radishes can be grown in Manáos, and this occupation affords employment to a large number of Portuguese market gardeners. We consider the State should encourage the people by exempting them from certain forms of taxation, so that greater quantities of produce could be grown and retailed at prices within the means of the indigent class. Fresh green vegetables are an absolute necessity, and should be within the reach of the poor as well as the rich. Such vegetables as potatoes,

cabbages, etc., have to be imported from Europe, and therefore are accounted luxuries. The supply of fresh milk is limited, as all milking-cows have to be imported, and it is chiefly used by invalids and rich residents. Practically all the milk is boiled before being consumed.

Artificial ice of excellent quality is manufactured. The more universal employment of refrigerators would be encouraged if the price of ice was reduced.

The slaughter-houses along the Igarapé da Cachoeira Grande and the central markets in the town are of recent construction and admirably serve their purpose. The sale of meat, fish and turtle, etc., is under medical inspection, and an efficient supervision is maintained.

The Santa Casa de Misericordia is the sole public hospital in Manáos for the reception of indigent patients. The institution was designed for about 160 beds, but this accommodation is inadequate, as the hospital has to care for the numerous patients arriving from the interior of the State. The wards are overcrowded for many months in the year, but despite such difficulties the patients are well attended to. Numerous improvements have been instituted, and a fully equipped operating theatre, outdoor and maternity departments, and a separate barrack for tuberculous cases, enhance the value of this hospital. The institution is managed by a lay committee who appoint a large staff of the local medical men, assisted by the Sisters of the Order of Santa Anna, to attend to the various departments. The medical work of the expedition was carried on in this hospital, and after an associateship of three and a half years, we can warmly testify to its excellence.

The Sociedade de Beneficiencia Portugueza conducts a well-planned hospital for the needs of the Portuguese colony. Mosquito bars are furnished for all the patients, and wire gauze screened observation and isolation wards are provided for the treatment of their yellow fever cases.

A small isolation hospital well removed from the city is used for small-pox patients and a few indigent lepers. A State lunatic asylum is in course of erection.

Another small hospital is maintained by the Federal authorities for the treatment of the Federal troops.

An admirable institution is provided by the State for the education of orphan girls. It is known as the Institut Benjamin Constant, and is thoroughly equipped on modern lines.

In former years the authorities inaugurated many extensive works which involved the raising of the levels of the low-lying areas, the filling up of some of the igarapés, and the making of extensive excavations. Unfortunately, as is often the case, mature consideration does not appear to have been exercised before undertaking the improvements. Igarapés were incompletely filled in; streets were made across swamps, thus damming back the waters; and street levels altered without a thought as to the consequences. The surface waters draining into these places created miniature lakes and swamps where, formerly, only puddles had existed. In 1897 and 1898 such works were in progress in all parts of the city, and with the excavating, filling and re-excavating which seems to have occurred, collections of water were multiplied all over Manáos, mosquitos bred in their thousands, and fevers reigned supreme. Hundreds of workmen were attacked with malaria, and the deaths from this disease alone rose to 1,074 in 1898 and to 1,495 in the year 1900. Happily for Manáos and her citizens such a condition of affairs is at an end, and the authorities are alive to the necessity of carrying out improvements methodically and with the collaboration and advice of the sanitary authorities.

During our residence in Manáos, 1905 to 1909, we have noted the efforts of the various departments in the direction of abolishing the many foci of water which had resulted from the past operations, and we desire to record our appreciation of the immense difficulties which have been successfully overcome. It is hard for a newcomer to realise how much has been accomplished unless he learns from old survey maps, etc., that where many of the buildings and streets are, at one time there was nothing but igarapés and swamps.

The situation of Manáos admits of many improvements being effected. There still exist too many low-lying areas of land in the very midst of the populated districts, which are either swampy throughout the year or, at any rate, during the rainy season. These swamps all serve as breeding-places for Anophelines, Stegomyia, Culex, etc. The propagation of flies is also encouraged by the populace being afforded opportunities for the depositing of refuse

which, in many instances, has been found to be of a most objectionable and insanitary nature.

Many of the streets are on a much higher level than the adjoining land. The market gardeners use the sloping land for the growing of vegetables; some of these gardens are situated in the heart of the city, a most objectionable feature, as the rain-water barrels and cisterns used by the gardeners for the storage of water are usually unscreened, and have often been found full of mosquito larvae.

The municipality has filled up many of these low-lying areas and heads of creeks (igarapés) with the soil obtained from the excavations of new streets and the cutting down of the high banks of earth in various parts of the town.

It is impossible to accomplish much with the means at their disposal. The soil has to be transported in small carts, so that the whole operation is very costly and tedious. A cheaper and far quicker method is by excavating with the steam shovel, combined with the use of a light railway and gravel cars as employed by the Manáos Harbour Company in the filling in of their works. This is well exemplified in the case of the new Alfandega, which is built entirely on filled-in land.

The general plan of the laying out of the streets in the new part of Manáos, in the upper residential sections and in the outskirts of the city, allows of wide streets, with abundance of air space.

Manáos resembles the majority of cities in which the old or original sections of the settlement consist of narrow streets and confined areas. In the old quarters and business section of the town the streets are narrow and the buildings closely packed together. All the available space has been built upon, and no thought has been given to ventilation or illumination. Many of the small shops and, in some cases, the offices of business firms are so crowded alongside and around one another as to preclude adequate ventilation and illumination. There is generally a back-yard adjoining, but it is small, and too often encumbered with barrels of water or empty boxes. In some yards wooden structures have been erected contrary to the by-laws of the municipality.

The type of house commonly seen in Manáos is of Portuguese architecture, and ill-adapted for a tropical climate. A small dwelling generally consists of a front room facing the street, an inner chamber

which is usually a bedroom and opens into the dining room; leading from this is a passage along which are a couple of bedrooms overlooking a little yard; a dark kitchen is at the end of the passage, and immediately adjacent to the kitchen, the latrine and shower bath. The inner rooms receive air and light only from the outer ones, while the sleeping quarters along the passage are lighted and ventilated from the yard.

Such cramped, ill-lighted and badly ventilated houses are usually occupied by five to eight persons. The air space is quite inadequate; and even the houses of the wealthy citizens are so packed together and planned as to prevent through ventilation.

The residents appear to have only one object in view, to live as near to the business section as possible, despite the exorbitant price of land and high rentals. Very few villas exist, and even these are largely constructed on the same lines as the smaller dwellings, dark inner rooms being universal. Bungalows with broad verandahs, and with rooms so adapted that a current of air can continually circulate, are regrettably rare. Owing to lack of space these can only be erected at some distance from the business quarter, but the tram service is so good that there is no reason why such residences should not be built.

The working classes, such as the Portuguese and Italian labourers, are often far more badly housed. They tend to gravitate to the midst of the city, and overcrowding is very common. On some streets are to be found low one-storied barracks subdivided so as to accommodate ten to twenty, and even forty people. Here the overcrowding is extremely bad, three and four people living in a low room, 3 metres by 4 metres, lighted and ventilated only by a wooden shutter and door, which are generally kept closed. The sanitary conveniences in such places consist of a latrine which is supposed to be used by all the tenants, but this is not always the case. The footpath in the yard is laid with ill-fitting stone flags, the rest of the narrow yard being unpaved and littered with uncovered barrels of water. The odour of urine and smell of human excrement is nauseating.

Sometimes these places are situated adjoining a market garden, as on Rua Dr. Moreira (Plan near 25) and other streets of the city. Some of the tenants are washerwomen, who must perforce do their washing here. Human beings herded together in such an area can

only breed filth and disease. In one of these places (Plan 25) the garden slopes down to the swampy land, which is only partially filled in and from which we have collected many Anophelines (p. 20). The native in the outskirts of the city, in his mud hut with thatched roof, fares better than do these people. It should be remembered that many of the tenants of these places are newly arrived immigrants. Can it be surprising that they should suffer from yellow fever, etc.?

Other tenements of a better class are scattered over the city. These have larger yards, and overcrowding is not marked. The sanitary arrangements are better, but are usually insufficient for the number living in the restricted area, while the habits of many of the tenants conduce to unhealthy surroundings.

Underground cellars are rarely seen, but many of the houses have low, ill-lighted basements which the residents adapt for kitchen and servant quarters. The authorities are adverse to such practice and try to prevent them being used as sleeping-quarters. The floors of a great many houses are only raised a half to one metre from the ground, ventilation being provided by a small iron-screened opening on the street. The screening is either too open or the bars are broken so that cats, rats and other vermin can enter. When the houses are sufficiently raised from the ground the inhabitants frequently litter the space under the flooring with old boxes and other rubbish. Such places are insanitary and favour the breeding of vermin which would be a serious matter in the case of an outbreak of plague.

THE BREEDING PLACES OF MOSQUITOS

In the City Proper.

Stegomyia calopus is to be found all over the populated districts of the city. It is not an exaggeration to state that 98 per cent. of all dwelling houses and places of business harbour, in the building or in the yard, foci of water which give the female *Stegomyia calopus* a place where she can lay her eggs and where the young larvae can hatch out.

One of the ordinances of the city is that all cisterns used for the storage of water must be screened with fine wire gauze. This ordinance is not always obeyed, and very often the screening is most defective (usually around the ball and cock of the inlet water pipe of

the cistern). The sanitary authorities summon householders for not having the cisterns screened, but too often is it the case that in a month or so afterwards the screen is taken off or propped up.

It is the custom of the householder to store his empty bottles in the yard. These are usually laid on the side and piled up at such angle that rain water is collected and another ideal breeding-place for the mosquito is provided. Empty tin cans, buckets, earthenware pots, etc., adorn the back yard, nearly all being so placed as to collect water. Very often these are only cleared away after an inspection has been made by the authorities, to be followed shortly by another collection of useless rubbish.

Barrels for rain-water are unscreened or covered with a loose-fitting top which more often than not is left off. Gutter and gutter pipes may be broken or blocked. All these, if defective, collect water and facilitate the propagation of the mosquito. Empty tins, bottles, even old baths, are often stored under the flooring and, when the floors are washed, water will drip through the cracks in the flooring and collect in the cans, etc. The usual method of washing a one-storied house is to throw a couple of bucketsful of water on the floor and then rub the boards with brooms and sluice on more water. We have seen the workmen, during building operations, too lazy to clear away the old tin cans and similar rubbish on the ground before nailing down the floor. (One house badly infested with mosquitos was a source of much worry to us until we took up a few boards and found some old saucepans partially filled with water and teeming with larvae.)

Many yards laid with cement have depressions or cracks in which water may lodge. The man-hole of the drain pipe in the yard for carrying off the rain-water may be so constructed as to allow of residual water to the depth of 1·5 to 2·0 cm. In some houses which have cellars underneath, we have observed collections of water on the floor, due to the splashing of heavy rain on the sidewalk, again resulting in the breeding of mosquitos.

Some window-sills and the accompanying rain-pipe are so constructed as to harbour an astonishing amount of water if the small drip-pipe gets choked. Rain has come down the chimney and remained in the rusty stove, and larvae have accordingly flourished.

In houses which have been vacant for some time one is almost sure to find evidences of larvae in the water of the closet pan.

Usually these houses have improperly screened or unscreened cisterns, and the cellars and back yards are often littered with a collection of rubbish which favours mosquito propagation.

In workshops the water-trough of the grindstone, the tub by the forge, and, in offices, even the water receptacle used for wetting the brush for the copying book have been found to harbour eggs or larvae.

Builders also too frequently neglect to screen the barrels used for storing water for mortar making, etc. In the digging of foundations for buildings the soil is heaped up and puddles formed. On the iron girders which are left lying about for a long time, rain-water can collect in the depressions.

In some of the street gully-pipes, at the man-holes leading to the sewers, the mouth of the upright pipe is fully 3·5 cm. or more above the surface of the cement. Here month after month quantities of Stegomyia larvae are found breeding.

The municipality is responsible for the existence of many fountains in the city which again are simply breeding places for mosquitos.

Swamps and Igarapés.

Numerous swamps* and igarapés are to be found in the city proper, and the inhabitants in these localities suffer from the effects of malaria.

The very extensive swamp in the valley at the back of Ruas Cearense, Ferreira Penna and Commendador Clementino (Plan 5), is responsible for the presence of much malaria and anaemia among the residents on both sides of the valley. In 1908 a partial filling was attempted, but up to my departure, in January, 1909, no improvement was observable. The sides of the valley are much contaminated with refuse. Many women use the place for washing clothes.

The igarapé crossing Rua Occidental behind Rua Monsenhor Coutinho (Plan 4) is also a prolific breeding ground.

The igarapé at the back of Rua Luiz Antony and extending up to Rua 10 de Julho (Plan 2) is a source of much disease. Much washing of clothes is done here, and the breeding of mosquitos is further helped by the barrels sunk by the washerwomen in the soil

* Newstead, R., and Thomas, H. W.; The mosquitos of the Amazon Region. Annals of Tropical Medicine and Parasitology, Vol. IV, No. 1, p. 141-142, 1910.

for the purpose of obtaining clean water. There are a very considerable number of these receptacles, and many Anopheline larvae have been obtained from them throughout the year.

The igarapé at the back of Rua Independencia (Plan 1), the head of which is now filled in by the Rua da Codeia, is still a breeding ground for mosquitos by reason of the dank vegetation along the sides. The back yards of many of the houses of Rua Independencia are flooded when the river is high. Up to 1908 there existed a large and deep body of water just east of Rua Codeia, which occurred from the incomplete filling up of this arm of the igarapé. Countless hoards of Stegomyia, Culex and Anopheline larvae bred there. Year after year cases of malaria and yellow fever occurred amongst the inmates of the neighbouring houses and hotels. By the complete filling in of this comparatively small area the authorities have destroyed one of the most dangerous breeding spots in Manáos.

A most prolific breeding spot is the low land near Rua dos Andrades along the projected Avenida 13 de Maio (Plan 25), where collections of water harbour many *Mansonia titillans* and *Culex fatigans* larvae. *Stegomyia calopus* abound in the houses of the neighbourhood. Some of the old houses are built on piles immediately over this foul-smelling water. During the rainy season, the back yards of many of the houses in the vicinity are flooded and the neighbourhood pestered by swarms of these mosquitos. Partial filling has been accomplished, and it is to be hoped that this will cease to be a danger spot.

The swamps along the proposed Avenida 13 de Maio, from Rua Candido Marinho up to and on the northern side of Rua 10 de Julho (Plan 6) are sources of propagation for both Anophelines and Culicines. The swamps on both sides of Rua 10 de Julho have contained, at all times of the year, larvae of *Stegomyia calopus*, *Cellia albimana*, *Uranotaenia geometrica*, *Culex fatigans*, and *Mansonia titillans*. Immediately adjacent to these swamps is the Hospital de Beneficencia Portugueza (Plan 7), and in its corridors we have captured from time to time Anophelines, *Uranotaenia*, etc. Not far removed from the other side of this hospital are other swamps from the Igarapé Manáos, all contributing their quota of Anophelines. As previously mentioned this hospital possesses several screened wards for yellow fever cases, but only mosquito nets for patients suffering

from other diseases, and, in the course of the year, many cases of malaria are under treatment in the wards.

Around the Igarapés Manáos and Bittencourt, larvae of *Cellia argyrotarsis* and *Ce. albimana* are always to be found. During the period of falling river many small pools and puddles are left which breed numbers of these Anophelines and swarms of *Culex fatigans* and *Mansonia titillans*.

At very low river the upper reaches of these igarapés are comparatively dry, but foci of Anophelines can nearly always be discovered. With rising or high river the larvae of *Cellia* are to be found along the edges among the dank vegetation clothing the sides of these igarapés.

Along the numerous arms of the Igarapé da Cachoeirinha (Plan 10, 15, 16) occur many breeding spots for Anophelines. The land in many places is low-lying and swampy for the greater part of the year, and only becomes dry at very low river. The breeding places for mosquitos are augmented very considerably by the number of pigs allowed to roam. These animals are always rooting about in the swampy land, and create numerous holes which retain water for a long time, and serve as favourite spots for the Anopheline ova and young. Along the ravines and swampy lands the inhabitants, in order to obtain clean water for drinking and washing purposes, sink small tubs and barrels into the sandy soil, and these have always been found to contain many imagines of malaria-conveying mosquitos. The occupants of the houses adjacent to the swamps and arms of this igarapé naturally do not escape malaria, as is evidenced by the very large number of admissions to the Santa Casa and Benificente Portuguese Hospitals. During the rainy season it is the exception to find these people free from the parasite. On the eastern side (Plan 26) of the igarapé the inhabitants of the houses along the bank and at the Colonia Oliveria Machado (Plan 24) all exhibit signs of the ravages of malaria.

In the North, which is the highest part of Manáos, the igarapés, swamps and ravines, as can be seen from the map, are fairly extensive. Villa Municipal (Plan 19) is situated in this section, and many Anophelines are bred in the swamps at the sides and back of the racecourse, near the Wireless Station.

Around the Plano Inclinado (Plan 3) are many spots for the

propagation of *Cellia albimana*, caused by the numerous indentations of the Rio Negro and the Igarapé da Cachoeira Grande. Malaria exacts a heavy toll from the residents of this district.

The suburbs of São Raymundo (Plan 23) and Colonia Oliveira Machado (Plan 24), on the far sides of the Igarapés Cachoeira Grande and Cachoeirinha, are on fairly high ground, but many ravines and swampy low-lying areas exist. The majority of the houses are situated along and in these areas.

Further outside the limits of the city, very extensive swamps occur. Unfortunately these districts are thickly populated by the poorer class, with a few residents of the better class. Near the old pumping station of the waterworks (Plan 21), the Bosque (Plan 22), Pensador (Plan 27) and Flores are a series of swamps which exist all the year round, and during the rainy season cover very extensive areas. From every one of these swamps larvae of *Cellia albimana*, *Cellia argyrotarsis*, *Culex fatigans*, *Mansonia titillans*, and *Uranotaenia geometrica* have been taken, and adult specimens captured in the houses of the inhabitants at the Bosque, Pensador and Flores. Numerous *Stegomyia calopus* have been found in the larger houses where rain-tubs and barrels are kept unscreened and full of water.

The Bosque, Pensador and Flores are prolific breeding places for Anophelines, and the residents in these localities suffer from malaria. The residents of these districts are responsible for many of the breeding-places, as they are too indifferent to fill up any of the shallow pools or to dig small trenches to drain the natural hollows. In these localities (Plan 22) much sand occurs which is used by the local builders; as a consequence extensive sandpits exist, which, during the rainy season, are full of water, and serve as breeding-places for both Culicines and Anophelines. Such foci occur all along the swamps and near to the houses. It is therefore not astonishing to find so many cases of malaria in proportion to the number of the inhabitants.

We fully realise the desire of the authorities to stamp out malaria in the confines of Manáos, and are aware of what has already been or is to be done.

Much good work can be accomplished by attacking the upper reaches of the Igarapés Bittencourt, Manáos, Tocos, S. Vicente and Bica. The filling of these igarapés must be gradual, as their extent

is so great; but when accomplished valuable areas of land will be available for building sites. Then again it would be advantageous if the upper reaches of the igarapés were filled in *to above* the level of ordinary high river. At the same time the banks and beds of these igarapés should be cleared of all the small trees, undergrowth and dank vegetation which grow so luxuriantly along their entire course. All the washing-pools used by the washerwomen should be either done away with or removed to one particular area, which will allow of their being inspected and kept free of receptacles which help to harbour mosquitos and their larvae. The pigs should be prevented from roaming about the areas of the igarapé and the necessary measures enacted.

Further, a small brigade of men should be appointed to discharge or fill the small pools left by the receding waters, draining the hollows where possible and only oiling spots which are absolutely impossible to fill or drain.

Rubbish should not be allowed to be dumped at these igarapés unless of material suitable for filling, and then only at those places which are being filled.

After the initial cleaning and stripping of the trees, brushwood, and high vegetation from the banks and bed of the Igarapés Bittencourt and Manáos, a small force of not more than four men should amply suffice to keep the two igarapés clean and to destroy the pools left by the falling waters.

A slight modification of the same measures would be necessary in the case of the Igarapé Tocos (Plan 2) and some of the small arms of the S. Vicente etc.

The ravine at the back of Rua Cearense (Plan 5) should be drained and the undergrowth and small trees destroyed. The washing-pools should be abolished altogether, and the inhabitants prohibited from using the waters for any purpose. Free drainage should be afforded by preventing the filling at the western end until the eastern section has been attended to.

THE DISEASES IN MANÁOS

The diseases which chiefly affect the death-rate in Manáos are malaria, yellow fever, beri-beri, ankylostomiasis, dysentery and other

infantile diarrhoeas, tuberculosis, bronchitis and pneumonia, typhoid fever and small-pox.

On none of the vast rivers flowing through the State of Amazonas are there any public hospitals, and the doctors practising in the settlements in the interior are few in number considering the vast extent of territory. Manáos has therefore to serve as a hospital base for all the up-river commerce.

Every steamer brings diseased persons from the interior of the State; many of them are already in the advanced stages of malaria, beri-beri, ankylostomiasis, etc. Their health undermined by the ravages of malaria and the privations they have had to undergo, many of them suffering from lack of sufficient nourishment (for actual starvation is not an uncommon occurrence in the interior during the season of low river, when it is frequently impossible to send up provisions), these people often arrive in Manáos in a most precarious condition. Many are admitted to the wards of the Santa Casa de Misericordia in a moribund state and thereby raise the death-rate of the hospital and the city of Manáos. The more fortunate ones make a very slow recovery, occupying the beds of the hospital for many days, and it speaks well for the medical and nursing staff that so many recover. We have seen as many as fifteen men from the Rio Madeira taken in an unconscious condition from a steamer, all suffering from pernicious malaria, almost pulseless, and yet with only a subsequent mortality of 60 per cent.

MALARIA

An accurate estimate of the prevalence of malaria in Manáos from the cases in the hospitals is impossible for the reasons already given. If we confine our attention to those found suffering from the disease in the suburbs, we are again at fault, as many Amazonenses suffering as they do from malaria, on returning from the interior will go and live outside the city and so raise the number of persons found infected.

The Brazilian of the poorer class who happens to be a rubber collector is of a necessity a rover, and will frequently change his district, going up the different rivers as employment offers and acquiring fresh infections, 'fever' being considered a necessary evil as the result of having to work up-river.

If these people are not too ill they will go and live with their family or friends in a hut situated in an Anopheline region. Very little quinine is taken, though their blood may be laden with gametocytes. They lie about in hammocks with no mosquito nets, and consequently these 'gamete carriers' serve to infect *Cellia albimana* and *C. argyrotarsis*, which are the common Anophelines of the swamps in the outskirts of Manáos. Thus the districts can be infected with the more virulent parasites of malaria. Generally the huts occupied by these 'gamete carriers' are overcrowded with children and adults, and consequently at a later date the other inmates are attacked with the same form of fever. Our case books record many such instances. At Pará a very serious epidemic of malaria occurred among the very poor inhabitants of certain districts, in which Anophelines abounded, by the return of labourers who had come down from the Alcoboça and Madeira-Mamoré works, and who were suffering from very severe attacks of malignant tertian fever contracted in these districts. These labourers being heavily infected, and living under most abject conditions, served as efficient hosts for the parasites. Shortly after their arrival a great outbreak of malaria occurred, necessitating the appointment of a medical commission.*

If we compare the malarial localities of Manáos with the figures obtained from a mosquito survey, we find that all the heavily infected localities represent those areas in which the greatest number of Anophelines are present throughout the year. In the city proper the number of Anophelines is not so great as compared with those in the suburbs, and therefore the number of new cases of malaria is far less than in localities such as Mocò and Pensador. Moreover, the condition of the inhabitants of the city is better than that of the poorer natives living along the swamps.

During our residence in Manáos we have examined many children and adults living in the suburbs, and especially those in malarial localities. As far as possible spleen palpation and blood examination was practised, and latterly an examination of the faeces was always made. Children do not object to being palpated, whereas they view with apprehension the necessary preparations for making blood films.

* Relatorio apresentado pala commissão nomeada para debellar a epidemia de impaludismo, reinante no Marco de Legua, Pedreira e Canudos. Belem. Imprensa official do Estado do Pará, 1909.

Moreover, a mother naturally objects to her infant's finger or ear being pricked. In order to obtain as many specimens as possible, free quinine, thymol, etc., was given to all indigent patients residing outside the city who were not attending the outdoor dispensary of the Santa Casa.

The following tables relate to a spleen and blood census practised on children from 6 months to 10 years of age.

APPARENTLY HEALTHY CHILDREN LIVING IN HUTS ALONG THE SWAMPS IN THE SUBURBS OF MANÁOS

Age	Children examined	Spleen palpable					Blood		
		I	II	III	Total	Percentage	Children examined	Parasites present	Percentage
6 months to 2 years	11	—	1	1	2	18·1	9	3	33·33
2 to 5 years ...	58	1	5	17	23	39·65	38	20	52·63
5 to 8 years ...	61	3	12	14	29	47·5	51	28	54·90
8 to 10 years ...	70	1	4	22	27	38·5	59	27	45·76

Total spleens examined...	200	Total bloods examined	157
Total spleens palpable	81	Total parasites present	78
Percentage palpable	45	Percentage infected ...	49·68

EXPLANATION.—I = Spleen greatly enlarged.
II = Spleen enlarged and edge projecting beyond ribs.
III = Spleen palpable but not projecting beyond ribs.

AILING CHILDREN—SAME LOCALITY

Age	Children examined	Spleen palpable					Blood		
		I	II	III	Total	Percentage	Children examined	Parasites present	Percentage
6 months to 2 years	45	3	4	11	18	40	43	20	46·51
2 to 5 years ...	81	4	15	22	41	50·62	72	39	54·16
5 to 8 years ...	68	4	11	20	35	51·47	38	23	60·53
8 to 10 years ...	76	6	12	13	31	40·78	25	13	52·00

Total spleens examined	270	Total bloods examined	178
Total spleens palpable	125	Total parasites present	95
Percentage palpable	46·29	Percentage infected ...	53·37

From these figures it is apparent that the swamps in the suburbs of Manáos are responsible for a considerable number of cases of malaria. Of a total number of 470 healthy and ailing children, the spleen was palpable in 206, or 43·82 per cent. Blood examination of 335 of the children showed malaria parasites to be present in 173, or 51·64 per cent. If we compare spleen and blood examinations made on children of the same ages, resident in Manáos and living near swampy and low-lying land such as Igarapés Bittencourt and Manáos, S. Vicente etc., the number of infected children is much the greater in the suburbs.

LIVING ALONG THE SWAMPS IN THE CITY

Age	Children examined	Spleen palpable					Blood		
		I	II	III	Total	Percentage	Children examined	Parasites present	Percentage
6 months to 2 years	21	1	—	1	2	9·5	18	5	27·77
2 to 5 years ...	64	1	3	5	9	14·06	47	14	29·78
5 to 8 years ...	33	3	7	4	14	42·4	33	18	54·55
8 to 10 years ...	59	1	6	12	19	32·20	49	22	44·89

Total spleens examined	177	Total bloods examined	147
Total palpable	44	Total parasites present	59
Percentage palpable	24·85	Percentage infected ...	40·13

COMPARISON OF MALARIA INDEX OF CHILDREN IN SUBURBS AND CITY

		Spleen rate		Blood rate	
		0–5 years	5–10 years	0–5 years	5–10 years
Swamps in Suburbs	Apparently healthy	36·23	42·74	48·93	50·00
	Ailing	46·82	45·83	51·80	57·14
	Average both classes	43·07	44·36	50·61	52·60
	City swamps ...	12·94	35·86	29·23	48·78

Thus we find that the spleen rate for the suburbs is 43·82 per cent. as compared with 24·85 per cent. for the city, and the malarial blood index in the suburbs is 51·64 per cent., in the city 40·13 per cent.

At five to eight years a greater percentage of children appear to show enlargement of the spleen and malarial parasites in their blood. Examination of 142 boys between the ages of ten and fifteen years, living in the suburbs, showed splenic enlargement in 51 cases, or 35'91 per cent.

Comparison of particular localities such as Mocò, the Bosque, S. Raymundo, Colonia Oliveira Machado, where the natives are of the very poorest class, shows a much greater percentage of children with malarial infection. In these places, quite 70 to 90 per cent. of the inmates of some of the huts are suffering from malaria. We had many opportunities of observing such conditions during the course of our work in the swamps, and many times have found whole families incapacitated.

On the other hand, our observations show that children and adults living in the city, and well removed from malarial swamps, remain free from malaria. Such non-malarial districts are not hard to find in Manáos, and as the sanitation of the city improves, so will the number and extent of these localities increase.

The majority of the Americans, English, French and Germans live in the business section of the city and remain free from malaria. When cases do occur, the infection can be quite easily traced. They have gone on a hunting or sailing expedition and exposed themselves to infection or are old '*imported cases*' from up-river or other parts of the tropics. Many Brazilian clerks are employed by these firms, and it is noticeable how much 'fever' there is amongst those who reside near the outskirts of the city and adjacent to the swamps. A considerable percentage suffer from *sezões* (ague) at some time during the year.

During our residence in Manáos we remained free from malaria, and no quinine was taken unless we left the city to pursue our work in the swamps.

Many supposed cases of convulsions, dentition troubles, and tetanus in children occur during the year, and more especially in the months when malaria is particularly prevalent. From our observation of these cases we think they are largely of malarial origin.

As we show in the section on ankylostomiasis, 88 per cent. to 93 per cent. of the children living in the suburbs are infected with *Necator americanus*, and practically all our cases of malaria exhibited

symptoms of this disease. It is not remarkable then that these children, their constitutions already weakened by ankylostomiasis, should be attacked and exhibit severe types of malaria.

The children who enter the Santa Casa are of course suffering from acute attacks of malaria, and exhibit the most severe symptoms of the disease. It is rare to find parents of the indigent class bringing their children to be treated for malaria ; the gravity of the disease is not appreciated, and consequently the cases are well advanced. Blood examinations of the children admitted for various diseases show that 50 per cent. to 70 per cent. are infected with malarial parasites.

If a hut-to-hut inspection in the swampy areas of the suburbs be made, from 20 per cent. to 80 per cent. of the adults will be found to suffer from malaria, the number varying according to the season of the year, condition of trade, and locality. Allowing for the *imported cases* living in these districts, we estimate that 20 per cent. to 55 per cent. of the population residing in Mocò, the Bosque, S. Raymundo, Colonia Oliveira Machado, part of the Igarapés Cachoeirinha, Castelhana, and western end of the Cearense Swamp suffer from malaria and can be ranked as *indigenous cases.*

These people may be attending the dispensary of the Santa Casa, but generally they do not do so, preferring to take an occasional dose of quinine or to treat themselves with one of the numerous proprietary medicines of which there is an enormous sale in North Brazil. It is quite common to find a poor native with four or five brands of pills in his possession, squandering the money which ought to provide him with nourishing food on a small phial of expensive 'silver-gilt' pills.

Malaria is most prevalent during the period of February to November ; the number of cases begin to increase some two months after the commencement of the '*rains*' (p. 9) and the rise of the Rio Negro (vide chart). The mortality is greater during the months of June, July, and part of August. It is in these months that the wards of the Santa Casa are overcrowded and the cases of pernicious malaria most numerous. In this period many of the *imported cases* from up-river arrive in Manáos.

The parasites infecting the children and adults are *malignant tertian, benign tertian* and *quartan,* this last type being always imported. Malignant tertian (*Plasmodium praecox*) are the prevailing parasites, and their destructive effect can be witnessed on all sides ;

in the children with chronic malaria, cerebral convulsions, etc.; in the adults in the cachectic state and in the large number of pernicious cases. In children, crescents are not hard to find and this was the case with all our patients; quite 80 per cent. of our malignant tertian cases harboured gametocytes, often in very considerable numbers.

Benign tertian (*Plasmodium vivax*) is fairly common, and was found in about 20 per cent. to 25 per cent. of our patients. Many cases of double tertian infection, causing a quotidian type of fever, occur in Manáos, and a certain amount of confusion has occurred in the diagnoses until microscopic examination determined if the quotidian fever is due to *Pl. praecox* or *Pl. vivax*.

Quartan (*Plasmodium malariae*) parasites were rarely encountered in our patients; in fact, all our specimens were obtained from cases coming from the Rio Purus, Rio Japura, and Rio Madeira.

The clinical types of fever are quotidian, tertian, continuous and quartan. Bilious remittent fever type is not rare. Algid and cerebral types are quite common. Pneumonia, dysentery, haemorrhagic purpura, nephritis, neuritis, optic atrophy, have all been seen and are due to malignant tertian parasites.

Many of the rivers of the State are famed for the extreme malignancy of their malarial fevers and the resistance of these to quinine. The Rios Acre, Javary, Madeira and Coary have long been noted for such types of fever, and examples of their malignancy are to be met with in the Santa Casa Hospital. A quotidian type of fever, with an enormous number of crescents, resulting in an extreme degree of anaemia is encountered in cases coming from the Rio Madeira. Some of the doctors claim that there is a phenomenal resistance to quinine, but we cannot certify to this as quinine, as used in the Santa Casa, has worked wonders with these cases.

Blackwater fever. Cases of this disease are said to have been seen in Manáos. We have seen no case of genuine endemic haemoglobinuria in Manáos. In Iquitos and Manáos we have observed attacks in a man who had recently suffered in Africa from the disease. A special watch was kept for cases of this disease and the urines of all malignant malaria patients, especially those from the Javary and Madeira rivers were collected, but in none were we able to find any of the characteristic symptoms.

We desire to record the fact that since the last quarter of 1909

cases of typical blackwater fever have occurred amongst the people employed in constructing the Madeira-Mamoré Railway in the vicinity of Porto Velho on the Rio Madeira. During 1908 we had opportunity of observing many severe cases of malaria which were brought from the Madeira-Mamoré Railway to Manáos and treated in the wards of the Santa Casa, but we failed to find a case of blackwater amongst these men, either in the wards or post-mortem room. Among the working-force are Cubans and workmen, engineers, etc., brought from Cuba and the Isthmus of Panama, both blackwater fever regions. These men were brought to the Madeira river about 1908. It is of interest to record that the Booth Steamship Company* in its long connection with the Amazon region, never carried a case of blackwater until November, 1909, when a severe case was observed in a Spaniard who had been working up the Madeira river in the railway camp. We hear that other cases have been treated in Manáos (1909-10.)

YELLOW FEVER

This disease in 1856 attacked two-thirds of the population of the State; in 1861 another epidemic occurred. The fever appears to have been severe in 1899 and 1900.

For the foreigner this is the most serious of all the diseases to which he is liable in Manáos. The foreign population of the State is chiefly resident in Manáos, and the number of foreigners is sufficiently large to make the disease a very serious one.

We have already reported the overcrowding which prevails in certain of the streets of the city. These houses and barracks are mostly inhabited by Portuguese, Italian and Spanish labourers, and a great many of the newly arrived immigrants settle in these streets until employment is secured or a home arranged for.

We have shown that *Stegomyia calopus* abounds in all quarters of the city and that its existence in such numbers is due largely to the habits of the citizens. The foreigner is equally culpable, as his house or office provides numerous breeding places for the mosquito.

We acknowledge the efforts of the sanitary authorities to stamp out this disease. They inspect the houses and endeavour to abolish

* By permission of Dr. Melville Davidson, Medical Superintendent, Booth Steamship Company.

the breeding places of the Stegomyia. It is only when one attempts to fight this mosquito that a comprehension of the difficulties to be surmounted is really gained.

Stegomyia calopus is essentially a house mosquito. The female is not a 'rover' and keeps to a small area provided that she can obtain blood. She will lay her eggs in all kinds of receptacles capable of holding water, in fact, she often appears to choose the most unlikely places. The larvae and nymphae require a very small quantity of water and appear to be far more hardy than many of the other Culicinae.

The average dwelling-house or office in Manáos affords the Stegomyia an excellent propagating place—receptacles containing water abound in the houses and backyards, underneath the floors, and in the various other places which we have already enumerated. The climatic conditions of Manáos are ideal for the breeding of the mosquito. There is plenty of rain, the humidity is considerable, the temperature is suitable, the breeding spots are ready. All of these conditions are present throughout the year. Certain months are especially favourable for the development of the young, viz.:- September to January.

For the propagation of the disease there are numerous female Stegomyia all prepared to feed on a yellow fever patient. The opportunities for doing so are numerous, as the class mostly afflicted by this disease are careless in the use of the mosquito net. If there is a net it may be torn or, more probably, it will not be used during the day. As has been so often verified, it is the young female *Stegomyia calopus* which, ravenous for food, flies about and bites during the day time. Hereafter she is more cautious and will bide her time, nature teaching her to bite during the gloom. Hence, once the cycle period of twelve days is complete, she will be dangerous for any non-immune who lives in the city proper in an unscreened house or sleeps without a mosquito net.

It has already been proved that a certain temperature is requisite for the development of the cycle in the mosquito, and the maintenance of the virulence of the virus. The climate of Manáos favours this, as the preponderance of our cases of yellow fever occurred in or after the four hot months of the year.

Yellow fever can occur at all times of the year; usually the

latter part of June, July and the first half of August are the months with few cases. Occasionally it has happened that we have seen no cases for four to six weeks, and consequently our experimental work has been seriously hampered. From September to January the cases appear to increase gradually; February and March may show a fall, and the number may continue to fall or rise again in the latter part of May.

The source from which the female Stegomyia obtains her infection is the labouring-class foreigner and the native child.

We deplore the custom of the laity in attempting to treat cases of fever occurring among their friends and relatives. The Portuguese, Italian and Spanish nationalities form the preponderating foreign labourer class in Manáos, and therefore they are the greatest offenders.

Should a foreigner, especially a new comer and non-immune, exhibit malaise, headache, pain in the back and lower limbs, a tendency to nausea and some fever, all early symptoms of the disease, instead of calling in a doctor to diagnose and treat the case, home remedies are given. Sometimes a purge is taken, but unfortunately it is not generally administered; food is not withheld, and the patient may force himself to eat the most unsuitable food for one in his condition; a sharp mustard plaster to the calf of each leg is applied and kept on until large blisters are formed. This is supposed to be an excellent remedy, and is almost universally used. The patient may lie in bed or attempt to go about his work; in any case he is unscreened and exposed to the bites of the hungry Stegomyia—thus during the first few days of his illness, the only period of the disease at which he is a source of infection, he serves to nourish and infect the numerous Stegomyia which have taken up their abode in his surroundings.

As the disease progresses and the symptoms become more and more defined, his condition becomes worse, and a doctor is called in at the end of the third or fourth day. Of what use is it to screen him? The period of infection is passed, his blood is no longer infective, the appetite of the Stegomyia is already satiated. Probably the first three days of the disease are completed: the days which are so important for the doctor, for it is the management and treatment of a yellow fever patient during these three days which materially influence the ultimate result. Of what use is it to call a doctor or to

come to the hospital if the patient is already in the throes of black vomit and exhibiting the prodromal symptoms of anuria? One of the saddest sights that can be continually seen in the hospitals is the entry of patients on the fourth to fifth day of the disease in a moribund condition. Many of these people would have recovered if only they had summoned a doctor or applied to the hospitals. Numerous Stegomyia would have remained un-infected and consequently there would be far less possibility of other foreigners and non-immunes becoming infected, as the number of infected Stegomyia would be greatly lessened.

Why should such a condition prevail? Is it the fault of the doctors and hospitals, the sanitary authorities, or the patient?

It is not the fault of the doctors and hospitals, as they continually urge the necessity for early treatment. It is not for lack of the necessary fees, because a doctor, after the first visit, will advise an indigent patient to go to the hospital. The hospitals are ready and willing. The Hospital da Benificencia Portugueza has a screened ward especially kept for the reception of yellow fever 'suspects,' where the patient remains until all doubts as to the diagnosis of the disease are cleared up.

The sanitary authorities publish from time to time the by-laws relating to yellow fever. All cases of the disease must be immediately reported under penalty of a fine. This is not sufficient. The by-laws should be amended to the effect that all cases of fever occurring in non-immunes, i.e., those persons who have not suffered from an attack of yellow fever, should be notified within the first twenty-four hours.

The screening* of all persons suffering from any form of fever should be made compulsory from the very onset of symptoms of fever.

All cases of fever in non-immunes must be examined by a doctor within twenty-four hours of onset of fever, and the diagnosis notified in writing to the Health authorities.

Foreigners unable to pay for a doctor, when suffering from fever, should on notification to the Department, be examined by the doctor appointed by the Sanitary Department, and, if found suffering from yellow fever, removed to the Hospitals.

* We understand that there is an ordinance to this effect in the regulations of the Health Department of the City of New Orleans.

All foreign immigrants arriving in Manáos, should notify the Sanitary Department their place of residence, occupation or trade, and to each one should be delivered a copy of the by-laws relating to screening of fever cases.

The foreigners of the business class are accustomed to call in a doctor at once, as they realise the seriousness of yellow fever and the benefit derived from early treatment. The regulations would not inconvenience them, but they and their doctors would be compelled to send early notification of 'fever' cases, and the diagnosis made to the responsible authorities.

The classes that would benefit by the regulations would be the foreign labouring classes: the very ones who by their ignorance of the danger from the Stegomyia mosquito and the non-screening of 'fever' cases, greatly assist in the continuance of yellow fever in Manáos.

We believe that after a few sharp fines had been administered a salutary lesson would have been learnt and the screening of all fever cases would be performed as a matter of course, even in houses where, under normal conditions, the use of mosquito nets was not universal. A further advantage would be that cases of malaria in the gametocyte stage would be protected from infecting the Anophelines.

In reality there would be very little hardship from such ordinance, as the majority of the Brazilian and foreign residents use mosquito nets. They are accustomed to use the net only during the night. Hence the law would compel the sick to be screened day and night. For the very poor residents who have not the money to afford a net the hospitals are the proper place.

We admit that the difficulties will be great, but only for a time. After a short period all the inhabitants, including the labouring-class foreigner, would become aware of the fact that non-compliance with the screening regulation entailed an immediate fine. Secondly, the non-immune would learn that the more the cases of fever remained unscreened, the greater would be the number of yellow fever cases, and for his own protection he would compel the 'fever' sick to use a net. Man is of a selfish nature, and the desire to live is predominant in every normal person. Let the lower classes learn to fear yellow fever, teach them the ways to avoid the disease, and one of the main difficulties will have been overcome.

Brazilians arriving from non-yellow fever States occupy the same position as do the foreigners. They are non-immunes, and are susceptible to the disease. We have attended cases of the disease occurring in natives and Indians from the Acre and Purus districts, and in children and adults coming from southern parts of the Republic.

The Brazilian child is susceptible to yellow fever, and we have had opportunities of studying the disease in infants and young children from one to two years of age. The symptoms are of such a character that a diagnosis can only be made with extreme difficulty. In the average case the mildness of the symptoms cannot attract the attention of the mother. Irritability, crying, mild bilious vomiting associated with slight fever in an infant only a few months old is almost always ascribed to gastric disturbances. The more so as the infant recovers in a few days. With children there may be languor, possibly headache, disinclination to eat, mild fever, and possibly vomiting; the child may be up and moving about, its urine may or may not contain albumin and casts; thirst is always pronounced; vomiting may be absent, but it is only when 'black vomit' occurs that the parents have any idea of the child's disease.

With such vague and insidious symptoms it is not astonishing that no precautions are taken to prevent Stegomyia from biting these children.

We have been fortunate to see a number of mild cases resembling influenza, gastric disturbance, etc. with fever of the types so well described by Marchoux and Simond.* Our own attack in 1905 was very mild, resembling influenza and exhibiting no albumin in the urine, and yet we were protected and became an ordinary 'immune.'

Many Brazilians suffer from most suspicious symptoms which, if occurring in a foreigner and non-immune, would be ascribed to an attack of yellow fever. It is worthy of note that these cases usually occur when there are other cases of yellow fever in houses in the neighbourhood. We hope to publish at a later date our observations of a series of these cases in adults and children and the infection resulting from them.

We do not think it necessary to present any clinical data regarding yellow fever, as the symptoms, etc., have been so often described. It

* Marchoux, E. et Simond, P. L.; Études sur la fièvre Jaune. Ann. de l'Inst Pasteur, Fev., 1906.

is our intention to defer the publication of our clinical report until we can present a more complete monograph embracing the pathological and experimental work of the laboratory. Autopsies have been practised on all the available material and careful records kept of the numerous cases seen during our residence in Manáos.

Ronald Ross* has always pointed out that 'a locality is malarious only when it contains persons already infected with the parasite, and also *sufficient numbers* of the proper species or varieties of Anophelines to carry infection to healthy persons.' Gorgas,† in his anti-yellow fever work, terms this the yellow-fever 'point,' and contends that a certain proportion of Stegomyia mosquitos must be present in a locality for the spread of yellow fever. If the number of Stegomyia remain above this 'point,' the locality will continue to have yellow fever as long as non-immunes are present, no matter how much fumigation is done or how carefully the sick are isolated. If anti-stegomyia measures are vigorously carried out and the Stegomyia so reduced in number that they are below this point, then yellow fever disappears. Gorgas thus explains the success of the Havana and Panama measures, and the reason why so long a period elapsed between the active starting of the campaigns and the stamping out of yellow fever in these places.

.. Can Manáos be freed from yellow fever?

We see no reason why yellow fever should not be absolutely stamped out of the whole of the Amazon district and the cities of Pará and Manáos in Brazil and Iquitos in Peru freed of this scourge.

To attain freedom from yellow fever will take time and money, and it will require the active co-operation of the authorities, the Brazilian and the foreign residents of the city. Stegomyia will have to be continually attacked. War cannot be waged against this mosquito for a few months only. It must be fought throughout the whole year. We do not have to go outside of Brazil to find an example of what can be accomplished in fighting yellow fever. The city of Rio de Janeiro was a veritable 'inferno,' but, thanks to Oswaldo Cruz, yellow fever is conquered. We know of no more striking example of what sanitation can accomplish than is evidenced

* Ross, Ronald. Report on the prevention of malaria in Mauritius, 1909.

† Gorgas, W. C. Method of the spread of Yellow Fever. Proceedings of Canal Zone Medical Association, 1908.

by the mortality statistics of Rio. Only a few years ago thousands of deaths were due to yellow fever; to-day Rio de Janeiro is absolutely free of cases of this disease.

The man who accomplished such a miraculous change experienced a difficult time. The citizens did not appreciate his methods and desires, his opponents were numerous and the methods they used were various. Only his dogged determination in continuing the anti-stegomyia measures saved Rio from remaining a plague spot. To-day his name is honoured, and the largest and most progressive Bacteriological and Medical Institute in South America is the Instituto de Oswaldo Cruz.

We do not believe that Stegomyia reduction will prove so difficult in Manáos as it was in Rio. It is not such an old city. The streets are wider, the buildings are not so cramped as in the old yellow fever quarter of Rio. Manáos has not the number of foreign emigrants that Rio had.

It is to the interest of the State of Amazonas that Manáos should be freed from yellow fever. The population of the State, considering the vast territory, is small. Immigrants of all nationalities are needed to develop the agricultural and cattle raising districts and to increase still further the commerce of the interior, and the rubber industry.

So long as there is even the suggestion of yellow fever occurring in Manáos the emigration to Amazonas will be greatly restricted. The peasant and artisan class of the Latin races will not care to emigrate to North Brazil as long as they know that the South of the Republic and the city of Rio means freedom from yellow fever. The State authorities must realise that every Portuguese or Spaniard falling ill, and perhaps dying of yellow fever, means a further blackening of the reputation of Manáos. Even if these people have no relatives in Manáos, their countrymen will record their deaths from this disease, and their relatives in Europe will magnify the dangers accordingly. The saying, 'give a dog a bad name and it will stick to him' applies in a special degree to Manáos.

Yellow fever is a preventible disease, and other nations look askance at those districts where yellow fever prevails. Year by year the number of these infected localities is decreasing and, as the numbers diminish, so will the demands for the eradicating of the remaining spots become a matter of international interest. It is

certain that other yellow fever centres in Brazil will follow the example of Rio, Santos, etc. Let Manáos and Pará be in the front rank and prepared to reap the benefits which will occur from a yellow fever-free city and improved hygienic conditions.

Manáos possesses a Director and a Sanitary Service. They have done their best to improve the hygienic conditions and to stamp out yellow fever from the city. Much has been accomplished, and there has been a considerable diminution in the number of yellow fever cases. We have seen various foci abolished. Much work has been performed with little money.

If the present Director and *personelle* are allowed a fair amount of money and freedom of execution they will be able to put into operation the methods which have proved so successful in Rio, Havana, Panama and New Orleans.

Gorgas claims that the most expeditious and certain method of freeing a place from yellow fever is by waging war on the Stegomyia and reducing the numbers to below the yellow fever 'point.' Fumigation and isolation should be practised, but the main efforts should be concentrated on reducing the number of Stegomyia breeding in the place. In the long run this will prove less expensive and will be easier of execution in Manáos.

Manáos has a pipe-borne water supply and a good drainage system, two most valuable adjuncts in any anti-mosquito campaign. The area of Manáos proper is not extensive; the work can therefore be concentrated.

We have already experienced what can be accomplished by a small brigade. The Manáos Harbour, Limited, and the Booth Company in 1908 put one to three men on anti-mosquito work, specially to look after the precincts of their warehouses, offices, workshops, docks and lighters. We supervised the earlier inspections, and have verified the enormous diminution in the number of mosquitos and breeding spots. At first, the results were not satisfactory, as the mosquito 'point' had not been reached, but later on the figures were highly gratifying. If such measures were instituted on a larger scale, the benefits would be experienced by all the firms and residents of the neighbourhood.

ANKYLOSTOMIASIS

This is one of the most prevalent diseases in the State, and all parts of the Amazon region appear to be infected.

In 1906 we reported on the seriousness of the disease, as observed by us in Iquitos, Peru. We found all classes of the Peruvians to be infected, and we believed, from examination of the Indians, that the country right up to the base of the Andes was infected with this parasite.

In Manáos we have made a large number of examinations, and from our results we estimate that quite 88 per cent. of the population of the State of Amazonas harbour the parasite. All classes of the community show infection.

	Number examined	Number infected	Percentage
Hospital Patients—			
Children	193	180	95·26
Adults	783	691	88·25
Indigent Class—			
Children	452	433	95·79
Adults	398	394	98·99
Better Class—			
Children	419	405	96·65
Adults	490	378	77·14
Foreigners—			
Labouring class	187	123	65·77
Better class	69	28	40·57

Total examined	2,991	Children infected ...	95·67 %
Total infected	2,632	Adults infected	87·55 %
Percentage infected ...	87·99	Brazilians infected ...	90·71 %

These figures are in accord with the observations made in Iquitos, and show that the soil must be heavily infected.

The parasite has been found in infants of less than six months of age to old men of sixty-five years. The children in the suburbs appear to show severer infection and greater anaemia than children

in the city. In the Santa Casa, typical examples of the disease are nearly always to be seen. The stunted, vacant-looking, bloated, anaemic child with a protuberant abdomen is a common sight. Severe anaemia and slight oedema are frequent symptoms in adults.

The general public do not appear to understand the dangers arising from infection with this nematode. All of our severe cases of malaria exhibited considerable intoxication due to this cause, which materially retarded convalescence. We have not to wait until symptoms are pronounced to realise how seriously the health of the people is influenced by harbouring ankylostomes. Both children and adults exhibit the lassitude, disinclination to work, the inability to continue strenuous exercise for long periods, the susceptibility to gastro-intestinal disturbances, the lowered resistance to disease and proneness to manifest severe, and sometimes grave, complications when attacked by mild diseases; all of which are the result of infection with *Necator americanus*.

This disease should be feared, because of the danger of neglect of treatment until the symptoms have become pronounced, or, more probably, because the constitution of the individual has been so weakened and undermined that he can fall an easy victim to any of the diseases prevailing in the State.

Malaria, tuberculosis, dysentery and other diseases are seen in particularly severe forms in patients evidencing the toxic symptoms caused by the worm.

The habits of the people are responsible for the spread and general infection of the soil by this parasite. Public latrines in Manáos are absent; and therefore vacant lots or side streets are used for the committing of nuisances. In the suburbs there exists no system of drainage; only a few of the houses possess dry earth closets or privies The natural functions must be performed; and therefore the ground in the neighbourhood of the habitations is soiled by the evacuations of the residents of the locality. The native usually chooses the belt of undergrowth at the edge of his clearing, but often in wet weather the earth immediately around or even inside the hut will be contaminated by the occupants.

The vicinity of the washing-pools, the undergrowth along the footpaths commonly used by the people, the banks of the igarapés and ravines are all contaminated by excreta.

The climatic conditions are favourable for the development of this worm, and the custom of the people to go about bare-footed or wearing light shoes causes the skin of the feet and ankles to be continually dirtied. The children during their earlier years run about naked, and are always rolling on the ground.

Some patients can give a history of ground itch occurring between the fingers and toes, but usually no such symptoms have been observed. Children, especially of the poorer class, suffer from 'Amazon boils,' which occur about the ankles and lower part of the shins. They persist for some time and create large scars. It is possible that these boils are only an intensified form of ground itch which, through scratching and carelessness in cleansing, become infected with cocci and develop into chronic ulcers. We have examined portions of several ulcers, but nothing specific was observed.

We have been impressed with the severe symptoms present in many of our patients, in spite of the fact that they harboured comparatively few parasites, and we agree with other observers as to the toxic symptoms observable in these cases, which are altogether out of proportion to the number of worms found in the intestine.

Our patients have exhibited the ordinary symptoms noticed by all observers. We would call attention to a rather rare form. A patient in apparently good health will be seized with a rigor. The temperature will rise to 39·5° or 40° C., to fall after a few hours to normal or subnormal, or moderate fever may continue for one to two days. In one adult, two epileptiform seizures occurred, attended by a sharp rise of temperature. Examination of the blood will show a moderate amount of eosinophilia, but no evidences of malaria; there may be slight and transient albuminuria, and the faeces will contain an enormous number of ankylostomes. Thymol, an intestinal antiseptic, and small doses of calomel will quickly cure such patients.

Dirt eaters are not uncommon, and have been found at all ages. Children of six to eight years of age appear especially prone to acquire this habit. Other infected children may develop such idiosyncrasies as eating orange skins, chewing leather, or drinking filthy, even stinking, swamp water.

The mortality from this disease is uncertain, as many of the cases die from an intercurrent infection.

Ankylostomiasis is a satisfactory disease to treat, as efficient

medication is generally followed by marked improvement in the condition of the patient, in which the outward and visible signs can be noticed by the patient and his friends. In the case of undersized, imbecile children, the improvement can be so marked that it must be seen to be believed. We have seen a veritable idiot transformed into a bright, active child: a change which impresses the patients, and is a valuable aid in persuading other patients to take treatment.

We have used thymol, beta-naphthol and Mons' mixture of chloroform-eucalyptus. For children we prefer to give thymol or beta-naphthol in small doses, as the drowsy condition induced by the chloroform-eucalyptus mixture is apt to alarm the parents. When there is much weakness, oedema, or cardiac dilatation present, the treatment must be carried out with caution. Beta-naphthol has not acted well in our hands and is not to be compared with thymol, which is an excellent and reliable drug. The simple precautions which are advised for thymol medication should be observed; we have never seen ill effects, and the patients are rapidly cleared of ankylostomes. Only severe cases require to be treated in the hospitals. We have found it advisable to superintend the treatment of a person in a particular district, and when he is on the way to recovery to appoint him to supervise the treatment of the other local patients.

This is a disease which should be actively combated by the State. Treatment on a large scale should be carried out on the lines of the Porto Rican campaign. Malaria and ankylostomiasis should be fought together, as one disease influences the other. We have the advantage that both are suited for treatment in clinics, where the patients cannot have much medical supervision. Severe types of the disease should on no account be treated in the district clinics: they are the suitable cases for admittance into the hospitals.

BERI-BERI

In the hospitals a great number of cases of this disease are admitted from the river steamers arriving from the interior of the State. The Acre, Purus and Javary districts furnish many cases. Manáos proper, as well as the suburbs, supplies many examples of this malady.

The oedematous type is the most common, a mixed oedematous and paralytic form, and a pure atrophic type, are both frequently

seen. The galloping type occurs, and was of considerable interest to us in the year 1905, and again in 1907, because of its almost epidemic character. In these years we noted more cases of beri-beri coming from the interior of the State and suburbs of Manáos. It has seemed to us that beri-beri is increasing in the city, the suburbs, and the interior of the State.

We have seen no cases in children, though they are said to occur; all our patients having been from eighteen to forty years old. Over 90 per cent. were males. Brazilians are the chief sufferers from this disease, but Portuguese and Spaniards of the labouring class are also liable to become attacked.

The better-class foreigner rarely acquires beri-beri. No doubt this is largely due to the housing conditions and their preference for ordinary European diet.

The Brazilians, so long as they avoid overcrowding, and live in the city under hygienic conditions, and partake of a liberal and varied diet, remain free from the disease. When the better-class foreigner or Brazilian exposes himself by living in overcrowded quarters, amid unhygienic surroundings, on a poor and monotonous diet, his physical condition lowered by attacks of malaria, ankylostomiasis or dysentery, the possibilities of his acquiring beri-beri are very great.

We do not intend to discuss the etiology of this disease. The following points, however, may be of interest:—

Béri-beri is frequent in places where rice forms an insignificant portion of the diet.* In the gaol, where 25 per cent. of the deaths

*Reply received from Dr. Hamilton Rice, F.R.G.S.: Beri-beri met with in Indians.

1. District?
   Uaupes river, tributary Rio Negro, N.W. Amazons valley, Colombia and Brazil.
2. Villages on river or inland?
   On the river or upon igarapés leading into main stream.
3. Tribe of Indians?
   Guainanos, Tupi Stock.
4. If natives come in contact with white people, and if so have these whites brought beri-beri into the district?
   With a few caucheros who are inhabitants of the district, whose intercourse with other whites is extremely restricted, nor is there evidence of their ever having brought beri-beri into the country.
5. Nature of food of natives?
   Fish, monkeys, agoutis, tapirs, farinha, yuca, pupunhas, plantains and caxiri, a beer brewed from mandioca, large quantities of ahi, a very strong red pepper, are used.

are due to the disease, the prisoners only eat beans and dried goat's meat imported from Rio Grande do Sul and Uruguay. Very little rice is used in the Santa Casa. The poorer class, in the suburbs and in the interior of the State, prefer farinha (mandioca meal) to rice. Beans, salt-cod, dried meat, plantains, farinha and fruit constitute the diet of many families, and yet beri-beri occurs. Much of the material used up-river is old and mouldy, but this does not apply to Manáos.

Husked rice is used in Amazonas and is imported in sacks from Rio de Janeiro (arrôs national) and from Europe (arrôs carolino). It is well washed before being boiled, and is cooked for a long time.

We have devoted considerable time to the investigation of this disease, but with few encouraging results. A large series of blood cultures; a series of cultures of the patient's own colon bacilli, for agglutination with his blood serum, and cultures of organs at early post-mortem, and attempts to infect chimpanzees with rice or with food soiled with the faeces of beri-beri cases, constitute the principal

6. Do they take rice?
   No.

7. If no rice, what local farinaceous food?
   Principally farinha and yuca.

8. Do they obtain salt meat or fish? Can salt be obtained locally?
   Fish dried in the sun and preserved in tough, fibrous leaves for varying periods of time is used extensively. Salt obtained from traders and possibly from Indians of the Kerary, though doubtful.

9. Roughly give diet of natives?
   Consume very large quantities of çaxiri. Sun-dried fish eaten raw, and fish broths seasoned to a fiery strength with ahi, into which are dipped pieces of baked cassava bread. Green boiled plantains and farinha uncooked or boiled to a viscous consistency known as mingai, and baked or stewed pupunhas. This varied from time to time with tapir, monkey, agouti, paca, peccary, and worms.

10. Number of cases seen?
    Three. Two men, 35 and 45 years old; one woman, 20 years old.

11. Native ideas of the disease? (Do the natives desert the sick and move to another village or hut?).
    Apparently unable to differentiate one disease from another even though different symptoms manifest themselves. Sick not deserted.

12. Is there a possibility of beri-beri having been introduced from some infected district.
    No evidence of such.

13. Forms of Beri-beri?
    Paralytic. Galloping.

14. Treatment by natives?
    Removed to the darkest, least used or unoccupied portion of the maloca to be cared for by the wife or nearest women relatives. Hammock slung very low to ground. Pages or medicine men practice their ritual of passes, incantations, sucking and spitting to exorcise the Evil Spirit, but eventually desist as the patient grows worse and the poor wretch is left to fare as best he can.

part of our work. No definite conclusions can at present be deduced from the data acquired.

More fruitful results were obtained from the treatment of beri-beri patients. The removal to a clean dwelling, disinfection of furniture and clothes, a diet consisting largely of milk, raw eggs and raw beef juice, small doses of calomel followed by intestinal antiseptics—salol or beta-naphthol—expulsion of ankylostomes with thymol, and massage, have benefited patients who could not afford to leave the State through pressure of business.

The universal practice in Manáos is to send the patient away immediately the diagnosis of beri-beri has been established. The Brazilians are sent to the Southern States of the Republic, the foreigner to Europe. Delay of a week or two very often ends in a funeral instead of a sea voyage. Poor patients are assisted by the State or sent to Itacoatiara, a small place a few hours from Manáos. Patients with chronic debilitating diseases are advised not to remain in the wards of the Santa Casa, where they expose themselves to contact with cases of beri-beri.

The etiology of beri-beri is so obscure that it is highly desirable to collect as many data as possible regarding the disease in Brazil. The Société de Pathologie exotique, Paris, has appointed a Commission to enquire and collect information on the subject. North Brazil is one of the beri-beri centres, and is interested in the problem of the etiology of the disease. Much valuable information could be furnished by the States of Amazonas and Pará. We would recommend the appointment of a Commission in Manáos to collect data relating to cases of beri-beri occurring in the city and suburbs.

DYSENTERY

Amoebic dysentery is not exceedingly common in Manáos, and the majority of cases appear to occur in the suburbs, especially along the Igarapé de Cachoeirinha. The disease usually runs a severe course.

Bacillary dysenteries are numerous in Manáos, and are particularly prevalent during the months of February to August. Most of the cases come from the suburbs, where there is no drainage system, and where the soil is polluted by the evacuations of the inhabitants. The infection is generally of a mixed bacillary form, but we have had

patients suffering from a pure Shiga or Flexner type, agglutinating the specific sera. Vaillard's anti-dysenteric serum was used with most gratifying results in several acute cases. Unfortunately we were only able to import a small supply.

ABSCESS OF LIVER

Amoebic dysentery furnishes a few cases annually. We have to record the extremely rare complication of liver abscess following a severe attack of yellow fever. Two cases occurred, and from one a bacillus of the para-colon type was isolated from the pus. Both patients had exhibited exceptionally severe icterus, which had persisted for some months after recovery from the original disease. The abscesses were noted six and ten weeks respectively after convalescence. No history of dysentery was obtainable, nor was it probable that these patients had suffered from the disease.

DIARRHOEAS OF CHILDREN

Infantile diarrhoeas are of frequent occurrence in Manáos, and are the cause of a high mortality. The suburban child is probably already infected with malaria and ankylostomes, and therefore falls an easy victim to any gastro-intestinal affection. The diet of the average child of the respectable poor is ill-adapted to sustain and nourish its bodily requirements.

We have examined the faeces of many children suffering from severe diarrhoeas, and have found, in a child of four years of age, enormous numbers of Tyroglyphines, which were voided with every evacuation. Specimens were sent to England for identification, but the tubes were mislaid, and when discovered were so penetrated by mould that identification was impossible. We have had two cases in adults suffering from acute enteritis, accompanied by the discharge of much blood; in the blood clots hundreds of small acarines were moving about. Both patients remembered that they had eaten a large amount of fruit, over-ripe bananas, etc., and one of them had subsisted on mouldy farinha. All the patients were rid of these pests by irrigations of boric acid and eucalyptus. We have seen acarines in the faeces of people who had partaken of much cheese. These were probably *Tyroglyphus siro* L., and in these latter cases no

inconvenience was experienced from the presence of the parasites. Railliet, in his Traité de Zoologie, p. 691, states that acarines have been found by various observers in the stools of children suffering from dysentery. We believe these acarines are responsible for some of the severe diarrhoeas seen in children and the point would be worth investigating. One must remember, however, that varieties of these tiny mites abound on wood and other things; and caution is advisable before deciding that Tyroglyphus can produce diarrhoeas. In the case of the child and one of the men, we adopted every precaution and found the parasites in successive stools and the returned fluids of the clysters.

TYPHOID FEVER

In 1907 we performed an autopsy on a Brazilian who had died from typhoid fever. A small outbreak of the disease occurred in 1908. Cases of para-typhoid were seen in 1908; the blood of the patients reacted typically to cultures of para-typhoid A. We hope at a later date to publish observations on a number of typhoid, para-typhoid and para-colon infections which occurred in Manáos during 1907 and 1908.

Bacteriological examinations were made from time to time of the water-supply of the city, the cheap ice-creams and fruit drinks. The results are to be embodied in a later report to the authorities.

TUBERCULOSIS

Pulmonary tuberculosis is unfortunately a disease which appears to be gaining a strong foothold in Manáos and the poorer class shows a steadily increasing percentage of infection.

Overcrowding is a serious evil in Manáos. This can hardly be avoided as the population has increased far more rapidly than has the house accommodation.

Rents are very high, and consequently many families have to live in small houses where overcrowding must occur. Many of the houses are badly lighted and ventilated, and possess dark inner rooms in which several people sleep.

Promiscuous expectoration is a habit which is practised by the majority of the people as can be verified in public places and in

cafés. In the hospital great difficulty is experienced in controlling the public patients from spitting about the wards.

The authorities have a separate barrack for indigent patients suffering from tuberculosis. Unfortunately before this building was inaugurated some of the sisters of the order of Santa Anna became infected through nursing in the wards of the Santa Casa.

Tuberculosis appears to run a rapid course among the poorer class natives as is to be expected since they suffer from overcrowding, insufficient and inappropriate food. Dried goat's meat, salt cod and beans constitute a poor diet for patients suffering from this disease.

We believe from the clinical and pathological material at our disposal that tuberculosis is already proving one of those dangerous diseases which are attacking the people of the interior of the State.

Many of our cases were found to be suffering from malaria, and practically all of the indigent class harboured *Necator americanus*. With a combination of three such depressing diseases the prognosis for such patients is very gloomy.

A league against tuberculosis is active in Rio de Janeiro and it is to be hoped that branches will be formed in the cities of Northern Brazil, so that the people may learn the elements of hygiene.

PULMONARY DISEASES

Bronchitis and Pneumonia are frequently met with in the rainy season. The prognosis is grave in cases of pneumonia.

Pneumonia occurring in patients suffering from malaria is rare; the cases seen were all infected with malignant tertian parasites. The mortality is high. Pneumonia as a complication of yellow fever is fortunately rare. Lobar pneumonia occurred in nine of our cases, and was responsible for seven deaths.

WHOOPING COUGH

Epidemics of this complaint attack the children in Manáos and in the interior. In Iquitos, Peru, in 1906 we found over 50 per cent. of the children had the disease, and that it was causing serious loss of life amongst the Indians in Peru. Broncho-pneumonia is a serious complication and causes a high mortality.

STOMATITIS

We have seen several cases amongst children. All were complicated with septic pneumonia which proved fatal. We have seen malignant stomatitis in a man from the interior. The disease involved the cheeks, gums, tongue and probably the posterior nares.

We have seen no cases of measles, diphtheria or scarlet fever.

LEPROSY

A moderate number of cases occur among the residents of Manáos. Early cases have been seen where infection is said to have taken place in the Purus district. We have seen both forms of the disease; many anaesthetic ulceration cases were examined and the presence of the bacilli verified.

A small lazaretto would be a comfort for the lepers as some of them are in a wretched state.

SMALLPOX

The State furnishes free vaccine for a large number of the inhabitants. The sanitary department is to be congratulated on the success of their preventive and quarantine measures which have effectually checked the spreading of this disease on the various occasions when it has been introduced from the South of Brazil, Pará, or from up-river places.

ELEPHANTIASIS

We have seen several cases in which the foot was involved. The majority of the patients come from the southern parts of Brazil or Barbadoes.

CHYLURIA

Two cases of this disease were seen, both of which had been acquired in other countries.

GOUNDOU

One case of old Goundou was seen in a Brazilian. The man had been in Africa.

RECOMMENDATIONS

We suggest that the sanitary authorities be empowered:—

I. (*a*) To make a spleen census of all children in the city and suburbs of Manáos, and that this should be repeated every three to six months.

(*b*) That at the same time the haemoglobin percentage of all children should be ascertained, and those showing marked anaemia should have their faeces examined for ankylostomes.

(*c*) That all children suffering from enlarged spleens or ankylostomes should be given free quinine and thymol.

(*d*) That a supply of quinine tablets, specially coloured in order to prevent the sale of the State quinine, should be given to each school teacher or responsible person in the localities of the poor, and that such quinine should be available for the inhabitants of the locality.

(*e*) That, once a week, a free clinic should be held in each of the large districts of S. Raymundo, Colonia Oliveira Machado, Mocò and Pensador or Flores. That so far as possible attention should be directed to the treatment of malaria and cases of ankylostomiasis. It should be remembered that what the department desires to attain, is to cure the children and adults of malaria and rid them of ankylostomes. *Simple preparations of quinine, thymol, arsenic and iron are quite as efficient as expensive combinations of the same.*

Severe cases of these diseases and patients suffering from other ailments should be directed to apply for treatment to the outdoor department or wards of the Santa Casa de Misericordia.

II. (*a*) That separate cards should be published by the State giving a few simple facts about malaria, ankylostomiasis and tuberculosis and emphasising the dangers incurred by neglecting treatment.

(*b*) That one of these cards appropriate for the disease from which he is suffering should be filled in with the name of the patient and should be given him to use as his identification card for the suburban clinic and hospital dispensary.

(*c*) That every school should have posters on the wall depicting and giving facts about malaria and Anophelines, yellow fever and Stegomyia, ankylostomiasis, and tuberculosis.

(*d*) It should be made compulsory for the teachers of every class to teach the pupils the meaning of the posters, and simple facts in hygiene, and these facts should be revised by all the scholars at least once a year.

III. That a special and permanent force of men should be formed to act as a mosquito brigade.

(*a*) To destroy *Stegomyia calopus* breeding-places in the city proper.

(*b*) To inspect and report on the condition of every house and office within the city proper, noting the general cleanliness of the place and the amount of rubbish.

(*c*) That all rubbish should be removed free of charge after the first inspection, but that later collections of rubbish should be removed at the expense of the householder.

(*d*) That all yards and houses should be inspected monthly, and that extra inspections should be made of houses that are apt to be neglected and dirty. If found in such a condition the tenants should be summarily fined. That special inspections should be made of barracks inhabited by many people.

(*e*) That each householder should be compelled to affix in a prominent place the ordinances promulgated by the authorities concerning screening of cisterns and tubs, breeding of mosquitos, collections of rubbish and the screening and notification of all patients suffering from fever.

(*f*) That all places where building is going on should be inspected, and the builders fined if found guilty of breaking the by-laws.

IV.—Malaria Work.

(*a*) The Igarapés Manáos and Bittencourt should be attended to during falling and low river as already advised, p. 22.

(*b*) Avenida 13 de Maio (Plan 6 and 25) the swamps to be kept oiled until filled and drained.

(*c*) Marsh in Ravine Cearense (Plan 5) to be kept oiled until filled and drained.

(*d*) The hollows on certain streets should be filled.

V. (*a*) That the men already attached to the various public squares, should be held responsible for not allowing water to collect in the fountains.

(*b*) That the men already appointed to look after the roads and gutters within the city proper, should be held responsible for not allowing stagnant water to collect in the gutters.

We believe* that a permanent force of 30 men would suffice to carry out the anti-stegomyia measures and to inspect the places within the city where Anopheles are continually breeding. This force would include:—

1 Head Inspector.
3 Inspectors or *Moustiquiers.*†
1 Head Foreman.
5 Foremen.
17 Labourers.
1 Storeman.
1 Driver.
1 Clerk.

This would allow for 3 gangs each of 1 foreman and 3 labourers.
2 „ „ 1 „ „ 4 „

For some months in the year, the entire force would be able to devote their whole attention to combating Stegomyia, as the igarapés would require very little treatment during rising river. As the sanitary authorities have had a force of 13 men at work the additional expense will not be so great. We suggest that only energetic men who will take an interest in their work should be appointed as inspectors and foremen.

We suggest that the prisoners should be employed in removing the grass, weeds, pools, etc., from the swamps in the vicinity of the gaol.

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* For the various details in organising such a force, the measures recommended by Major Ross for fighting malaria in the Island of Mauritius can be modified to suit the local conditions.

† Ross, Ronald, *loc. cit.*, p. 113.

EXPLANATION OF PLAN OF MANAOS

1. Igarapé Sao Vicente. Formerly Stegomyia bred here plentifully in a large and deep pool, with many *Cellia albimana* and *Ce. argyrotarsis*, *Culex fatigans*, *Mansonia titillans* and *Uranotaenia geometrica*.

2. Igarapé behind Rua Luiz Antony. Fair number of Anophelines.

3. Plano inclinado. Many Anophelines.

4. Igarapé behind Rua Monsenhor Coutinho. Many Anophelines, some malaria.

5. Swamp behind Rua Cearense. Badly infected with malaria; Anophelines abundant.

6. Swamp along Avenida 13 de Maio. As in No. 1.

7. Portuguese Hospital. In neighbourhood of Nos. 6 and 8.

8. Swamp and igarapé (creek) along Rua Dr. Machado. Many Anophelines, some malaria.

9. Upper end of Igarapé Bittencourt. Many Anophelines, much malaria.

10. Large swamps, many Anophelines and much malaria.

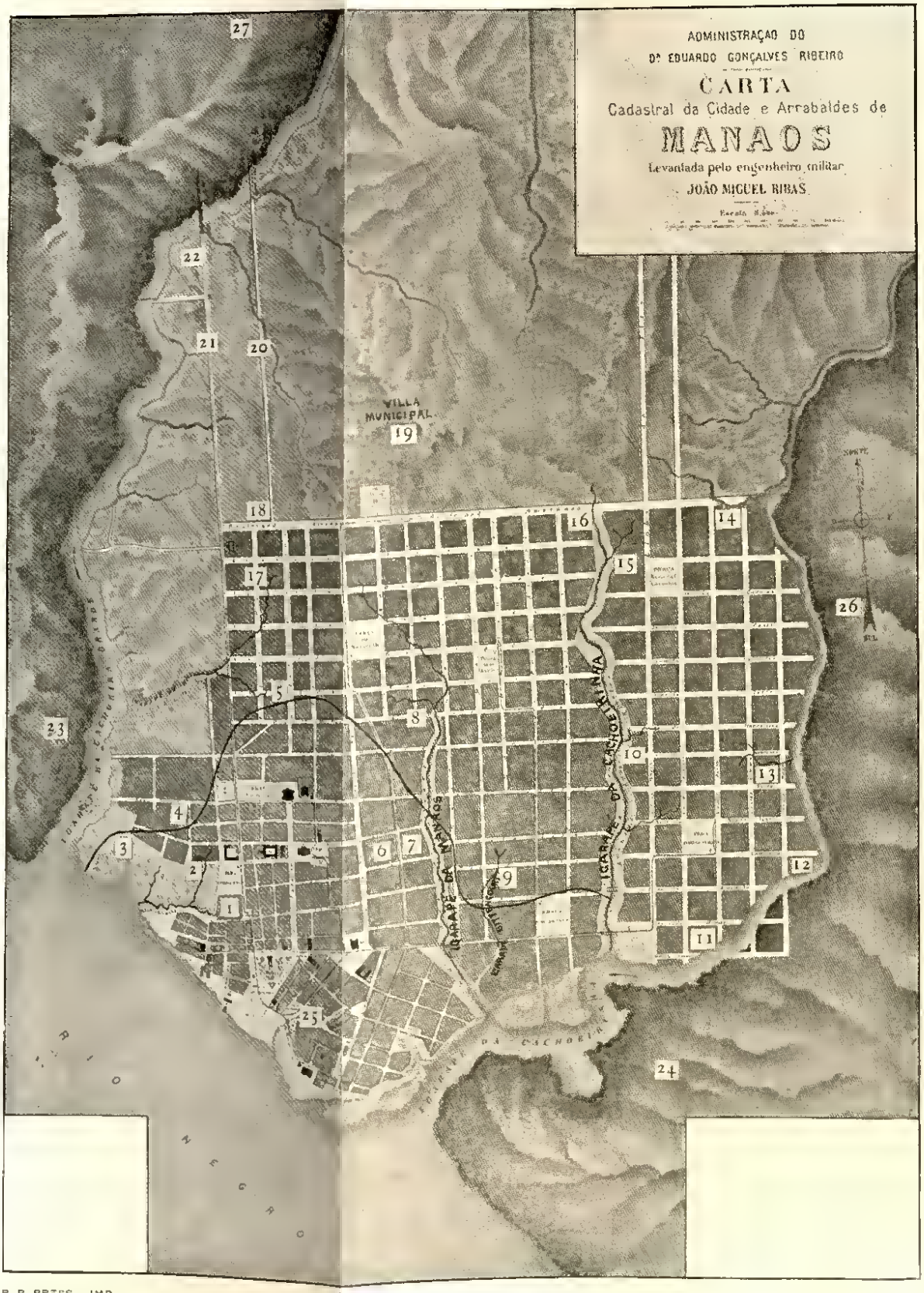
11 to 15. Large swamps. Many persisting throughout the year. Very heavily infected with malaria; abundant Anophelines and *Mansonia titillans*. Many of the poor inhabitants reside along these swamps.

16. Same conditions, but not so marked as Nos. 11 to 15.

17. Igarapé Castelhano. Heavily infected with malaria; Anophelines abundant. Many *Uranotaenia pulcherrima* captured.

18. Swamps. Not quite so heavily infected with malaria as No. 17.

19. Villa Municipal. Swamps abundant in neighbourhood and many cases of malaria in adjacent houses.


ADMINISTRAÇÃO DO
Dr EDUARDO GONÇALVES RIBEIRO
CARTA
Cadastral da Cidade e Arrabaldes de
MANAOS
levantada pelo engenheiro militar
JOÃO MIGUEL RIBAS
VILLA MUNICIPAL
IGARAPÉ DA MANGUEIRA
IGARAPÉ DA CACHOEIRINHA
IGARAPÉ DA MANGUEIRA
IGARAPÉ DA CACHOEIRINHA
RIO NEGRO
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20 to 22. Swamps very extensive. Many Anophelines and numerous cases of malaria. Near the wheel house of the waterworks several examples of *Megarhinus separatus* and *Mansonia longipalpis* were captured.

23. São Raymundo. District contains many swamps and is heavily infected with malaria. *Cellia albimana* and *C. argyrotarsus* very abundant. Many of the very poor inhabitants reside in the district.

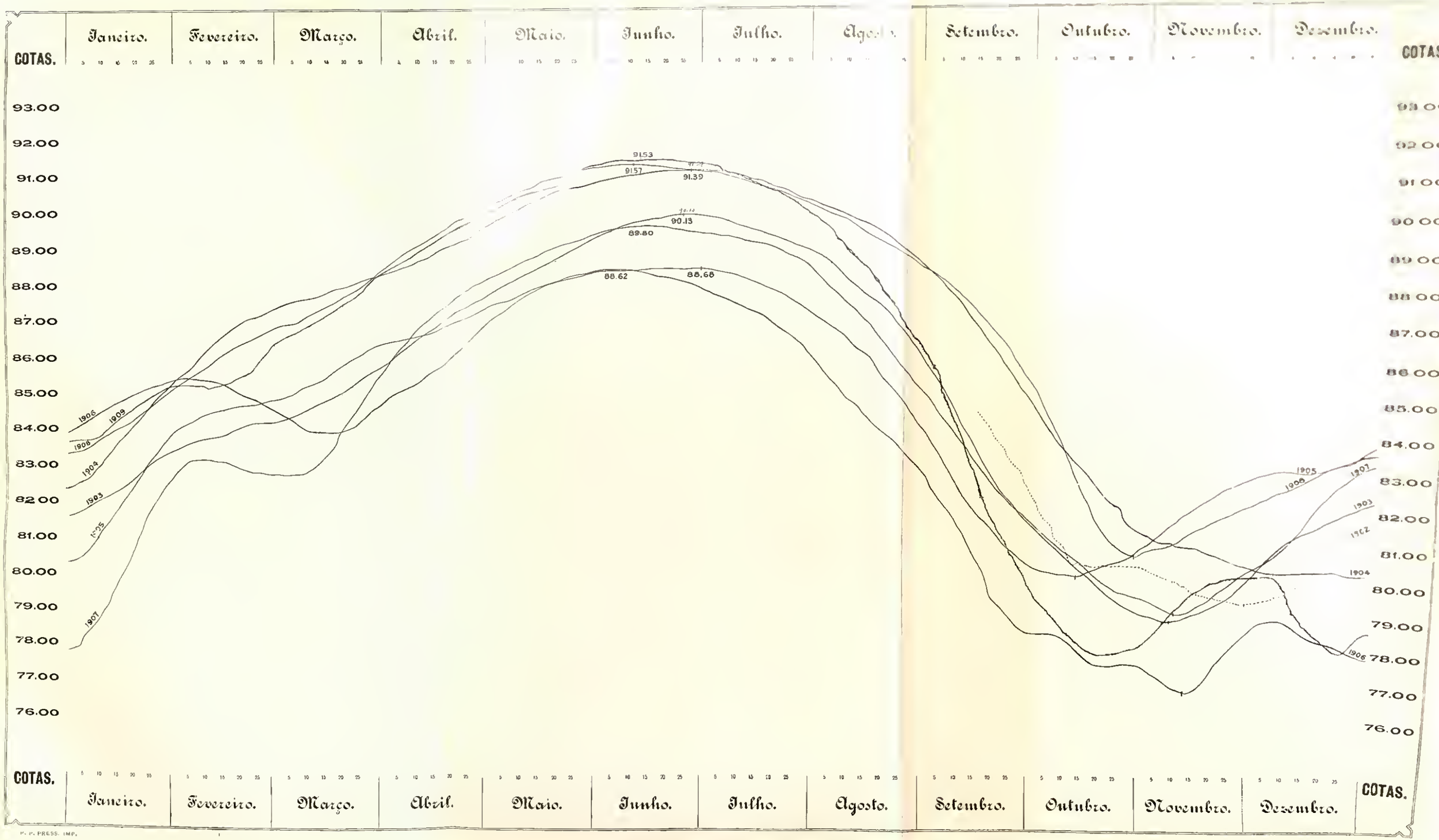
24. Colonia Oliveira Machado. Same conditions and class of residents as in No. 23.

25. Low land near Rua dos Andrades. Many *Stegomyia calopus*, *Mansonia titillans* and *Culex fatigans*. Many cases of yellow fever have occurred in the neighbourhood. A great number of newly arrived Portuguese, Italians and Spaniards reside in the houses, and create a serious condition of affairs through the overcrowding of the houses and their unhygenic habits, and the presence also of a number of unscreened water barrels.

26. Swamps. Heavily infected with malaria.

27. The Bosque, Pensador and Flores swamps are extensive. Many *Uranotaenia lowii* and *Ur. geometrica*. The Anophelines are very plentiful, and many severe cases of malaria occur amongst the residents living near these swamps.

The curved line traced near Numbers 3, 4, 5, 7, 9, to the Igarapé da Cachoeirinha roughly outlines the yellow fever area. Between this outline and the river front is the most densely populated section of Manáos, and the majority of the non-immune population reside within these limits. Included in this area is the older portion of the city. Outside of the traced outline many more Brazilians reside, and the blocks of streets are not so densely populated.



Manáos Harbour, Ltd.

Graphico do Fluxo e Refluxo do Rio Negro.